

## Dual Axis Radiographic Hydrodynamic Test (DARHT)

### **The Challenge**

Design a flexible robust Timing & Firing (T&F) and Data Acquisition (DAQ) systems to setup, execute and acquire data from a variety of hydrodynamic experiments fired at the Dual Axis Radiographic Hydrodynamic Test (DARHT) Facility, the nations newest and most complex firing site. DARHT is part of the DOE Stockpile stewardship program and is designed to certify the safety, reliability and performance of the US's nuclear weapons stockpile. The T&F and DAQ systems must be capable of expanding and adapting, to ensure that their accuracy and reliability are as high as current technology will allow.

### **The Solution**

Use LabVIEW to create an open architecture software package that allows ease of growth and flexibility. Use VXI to create a high speed, modular data acquisition system that is capable of thousands of channels of various signal types.

Los Alamos National Laboratory (LANL) is building a Dual Axis Radiographic Hydrodynamic Test (DARHT) Facility to measure the many complex dynamic aspects of simulated nuclear weapons. DARHT is part of the DOE Stockpile stewardship program and is designed to certify the safety, reliability and performance of the United State's nuclear weapons stockpile.

A nuclear explosion is initiated by crushing a fissile material, know as the PIT, until it reaches critical mass. This is done using High Explosives (HE). For testing purposes the PIT is replaced with a non-fissile material with similar properties. There are 1024 pins of many different lengths penetrating all around the weapons assembly. When these pins are shorted to ground by the implosion, the pulses are recorded on an oscilloscope. By knowing the lengths of the pins and the time differences between pulse a 3D picture can be generated to show the shape of the implosion. The DARHT software was designed to be a flexible robust control and acquisition system used to setup and acquire data from a variety of hydrodynamic experiments fired at the DARHT facility.

The DARHT software is made up of three major systems, Vault Control Module (VCM), System Monitor Program (SMP), and Capacitive Discharge Unit (CDU). The three systems combine into a control consol to create an easy to use operator interface that facilitates the control and acquisition of more than 2300 channels of data on 13 computers from a single chair.

Using LabVIEW as the development environment, allowed the customer to cost affectively modify the scope of the project. As DARHT includes 187 separate instruments this was an imperative selection in the overall success of the project. Additionally, the open architectural nature of LabVIEW as well as LabVIEW's capability of expanding and adapting to new technology so easily, combined to make LabVIEW the right choice for this project. For example a security policy change in the middle of the project forced a complete change in the program philosophy. Originally a single computer controlled the entire system. The policy change required the system to be split into three parts. Because LabVIEW was used to develop a modular program structure this change was relatively easy to incorporate.

## About NTS Test Systems Engineering

NTS TSE, located in Albuquerque, NM, designs and integrates test, measurement, automation, data acquisition and control systems utilizing diverse hardware platforms, operating systems, and instrumentation standards. Our expertise involves projects ranging from LabVIEW instrument drivers to full-blown automated turnkey systems. The dedicated staff of electrical and mechanical engineers, project managers and technicians of NTS are well versed in designing, integrating and programming real world solutions for industrial applications for a diverse set of operating systems and standards.



Test & Automation Services Include

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- Software Design & Architecture
- Instrument Drivers
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- Software Development (LabVIEW)
- Data Management & Analysis (DIAdem)
- Enterprise Solutions
- Fabrication
- Integration
- Installation & Training
- Maintenance & Support

**Contact**

To discuss how NTS can help you solve your next test system engineering challenge, contact Tim Brooks at 505-345-9499 or email [tim.brooks@ntscorp.com](mailto:tim.brooks@ntscorp.com).

